Simulations with Anechoic Chamber

A radio frequency "anechoic chamber" is a shielded room with walls absorbing the incident EM energy inside chamber.

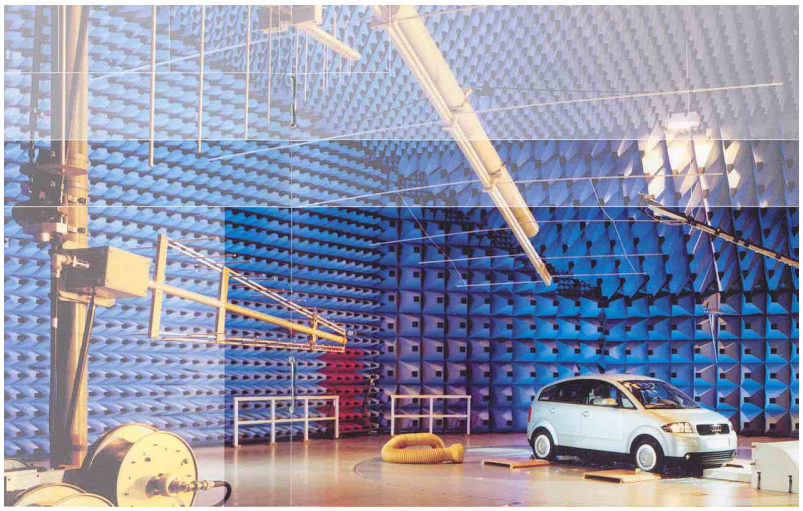

Fig. 1. Anechoic chamber

The walls of anechoic chamber are covered by highly absorbent material and support conditions similar to an OATS (open area test site) to make accurate EMC tests of standards on the measurement of radiated electromagnetic emissions.

An RF anechoic chamber could become an ideal EMC test site, useful for both emissions and susceptibility tests, if the absorber materials can adequately eliminate internal surface reflections over the test frequency range.

Taking into account properties of anechoic chamber simulation model of anechoic chamber test often can be constructed without walls and roof. However for the frequency range where absorbing properties of walls are poor, adequate computational model should be used.

Construction of computational model of anechoic chamber at low frequencies and analysis of field structure is performed within EMC Studio.

Problem Definition

Model of anechoic chamber with dimensions 20m x 25m x 10m is considered.

In low frequencies (below 30MHz) the anechoic chamber walls have poor absorbing properties and effect the field generation during EMC tests.

It is known that approximate level of field attenuation inside anechoic chamber at frequencies below 30 MHz is 5 dB. One of the possible ways to model chamber walls and roof that have poor absorbing properties is to use dielectric material for chamber bounds.

Influence of chamber walls with attenuation onto field generation is considered.

Two radiating structures are used for investigations:

- Log-periodic antenna
- Stripline structure

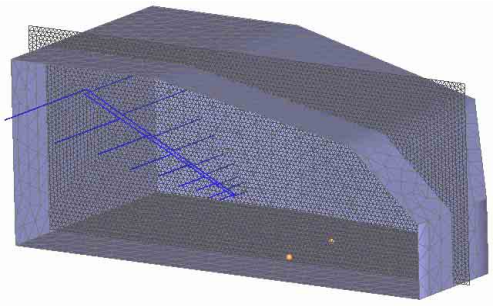

Fig. 2. Log-periodic antenna inside chamber

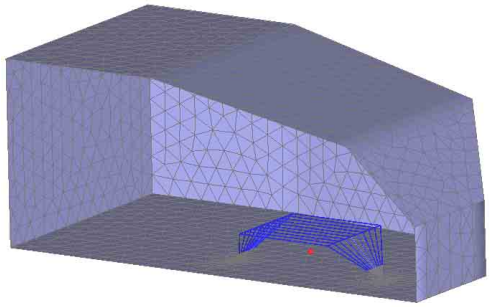

Fig. 3. Radiating stripline inside chamber

There different cases for simulations are used.

- Above perfectly conducting ground plane
- Inside anechoic chamber with perfectly conducting walls and roof
- Inside anechoic chamber with walls and roof attenuating 5 dB of incident field

Field attenuation of walls equal to 5 dB in complete frequency range (from 1 MHz to 30 MHz) is considered. For modeling of walls and roof

attenuating 5 dB of incident field surface impedance load of dielectric type in EMC Studio is used.

Frequency dependant permittivity of dielectric layer is presented in Fig. 4.

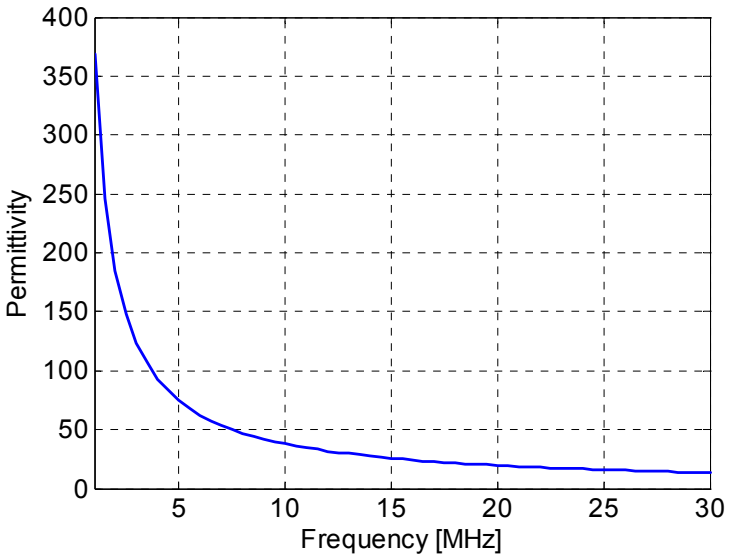

Fig. 4. Frequency dependent permittivity of walls

Electric Field in Reference Points

Electric field is calculated in reference points shown in the pictures Fig. 2 and Fig. 3.

Comparison of average electric field produced by log-periodic antenna and stripline in reference points for different environments is shown in Fig. 5 and Fig. 6.

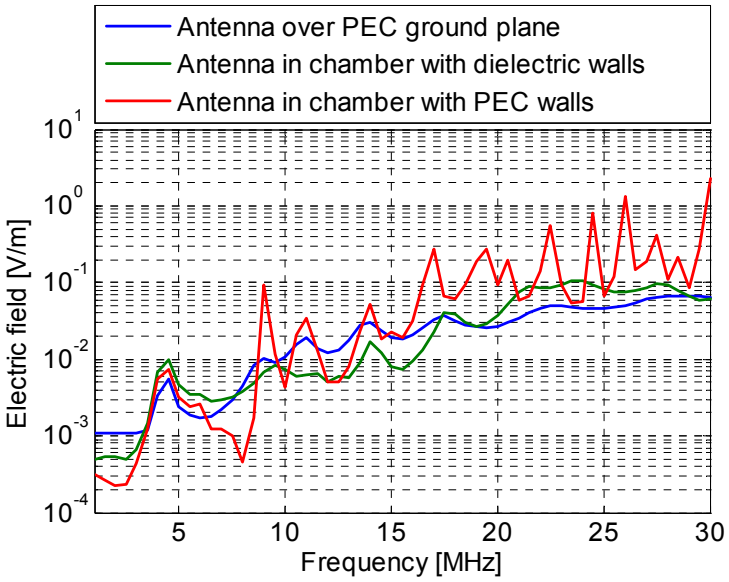

Fig. 5. Average electric field in reference points produced by log-periodic antenna

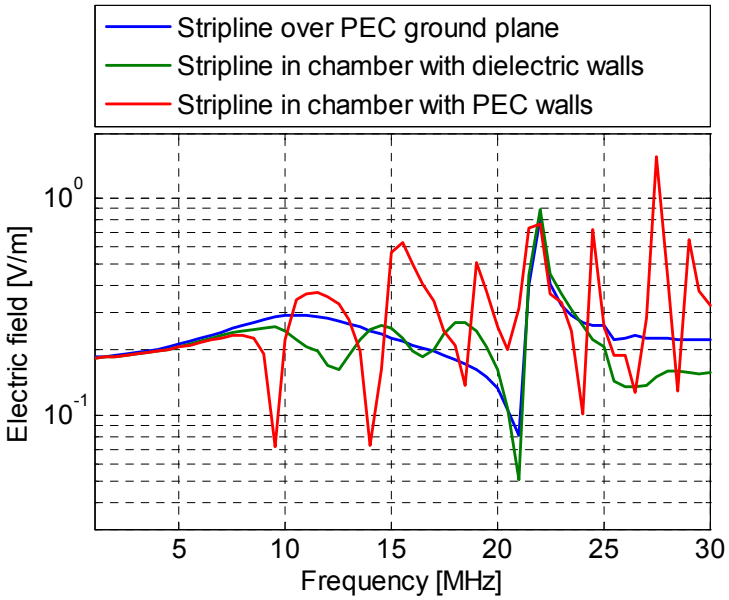

Fig. 6. Electric field produced by stripline in reference point

From the figure above it can be seen that field produced by log-periodic antenna and stripline in anechoic chamber with dielectric walls is closer to case when antenna and stripline are located above ground. In case of their location in chamber with perfectly conducting walls produced electric field has a lot of resonances.

Electric Field Distribution in Area, Crossing Antenna along its Boom

Additionally electric field distribution is observed in area, crossing antenna along its boom as it is shown in the pictures Fig. 7 - Fig. 10.

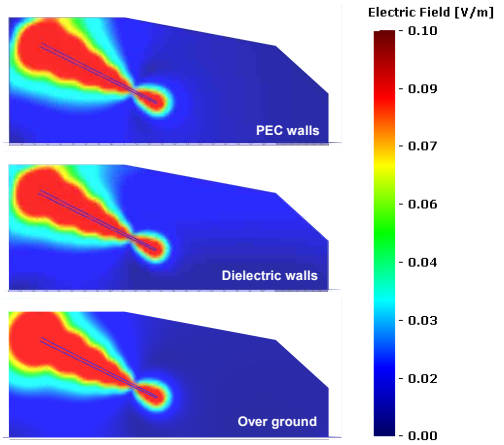

Fig. 7. Electric field at frequency 5 MHz

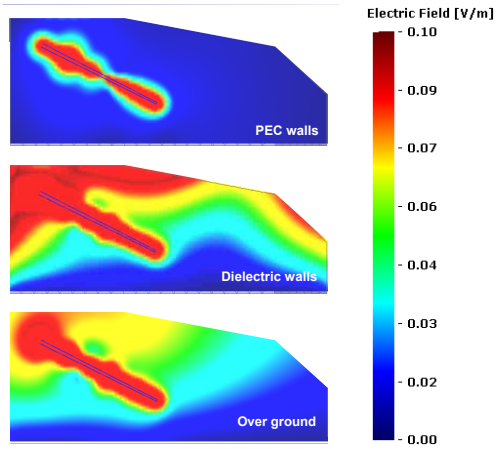

Fig. 8. Electric field at frequency 10 MHz

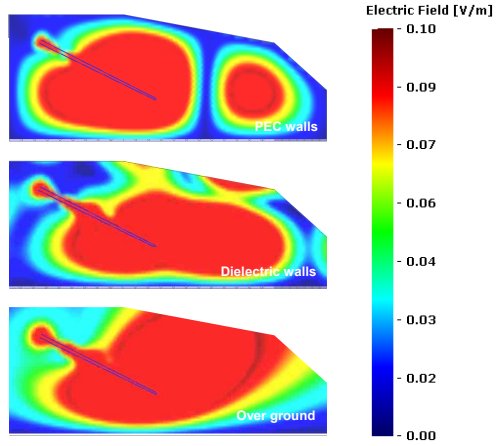

Fig. 9. Electric field at frequency 25 MHz

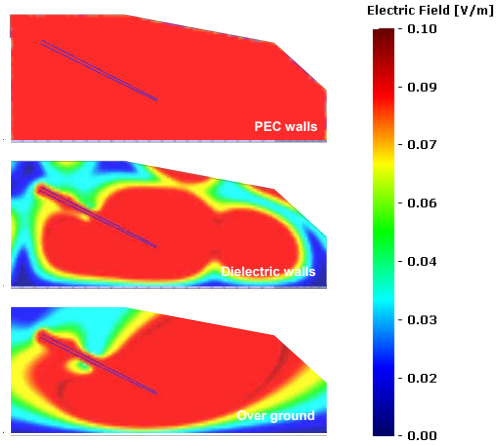

Fig. 10. Electric field at frequency 30 MHz

Conclusions

- Modeling of anechoic chamber walls characterized by poor absorbing performance can be done within EMC Studio